Original Paper

Digital Rural Governance and Its Impact on County-Level Farmer Income

Meiling Li[1] & Dehua Zhang[2]

[1,2] School of Finance, Harbin University of Commerce, Harbin 150000, China

Abstract

This study uses panel data from 275 counties in China between 2018 and 2020 and applies a two-way fixed effects model to examine how digital rural governance affects farmers' income. The results show that digital rural development significantly increases farmers' income, and this finding remains consistent after replacing the dependent variable. Based on these results, the paper suggests a phased policy rollout, strengthening support systems, encouraging industrial integration, developing evaluation frameworks, and enhancing digital inclusion to promote high-quality digital rural governance in support of rural revitalization and shared prosperity.

Keywords

Digital Rural Construction, Farmers' Income, Two-way Fixed Effects Model, County Economy

1. Introduction

In recent years, the digital economy has rapidly transformed the global economic structure and become a key area of international competition. China has made digital development a national priority, combining high-level planning with local experimentation, which has accelerated the progress of the Digital China initiative. Against this backdrop, the digitalization of rural governance has been advancing at a faster pace. The 2019 *Outline of the Digital Rural Development Strategy* called for using information technology to establish a modern rural governance system, bringing new momentum to rural revitalization. Digital rural governance essentially involves integrating digital technologies into various aspects of rural governance and economic activities, which helps improve resource allocation and stimulates internal development drivers. According to 2023 data, rural online retail sales nationwide exceeded 2.5 trillion yuan, and online sales of agricultural products surpassed 580 billion yuan, contributing to income growth for many rural households. The national rural e-commerce demonstration project now covers nearly 90% of counties, drawing young people back to their hometowns to start

businesses and enabling local specialty products to reach wider markets via livestreaming and e-commerce platforms. Meanwhile, the rollout of "Internet Plus government services" at the village level has cut down on time and administrative costs for residents. Some researchers estimate that a 10% increase in the level of digital governance corresponds to an approximately 2.5% increase in corporate investment efficiency. This suggests that a well-functioning digital governance environment is becoming a vital asset for counties in attracting investment and boosting economic activity.

This study aims to explore whether digital rural governance effectively promotes growth in farmers' income and the mechanisms behind it. To address these questions, we use panel data from 275 counties between 2018 and 2020, setting per capita farmers' income as the dependent variable and the digital rural index as the core explanatory variable. A two-way fixed effects model is employed to conduct the empirical analysis, with the goal of offering insights for policymaking and further research.

2. Literature Review

Early research on digital governance primarily concentrated on urban and macro-level government settings, with a focus on administrative efficiency and public service delivery. As the rural revitalization strategy gained traction, digital governance gradually extended to rural areas, giving rise to a distinct field known as "digital rural governance."

From a theoretical perspective, Liu Mingxuan et al. (2022) argue that digital governance can boost agricultural productivity by reducing information asymmetry and transaction costs. Liu Yisi (2021) suggests that emerging business models such as e-commerce and smart cultural tourism help overcome geographic barriers in rural areas, allowing county economies to become more integrated into national and global value chains, thereby expanding off-farm employment opportunities for rural residents. Zhang Lei et al. (2020) highlight that integrated digital government services improve grassroots administrative efficiency and lower institutional transaction costs. Li Jing et al. (2023) focus on public service equity, noting that digital services like remote education and online healthcare contribute to rural human capital development, thereby creating conditions for higher farmers' income. On the whole, existing studies largely agree both theoretically and empirically that digital rural governance influences county-level economic growth and farmers' income through multiple channels such as industrial efficiency gains, structural optimization, and human capital improvement.

3. Theoretical Framework and Research Hypothesis

This paper analyzes the internal logical relationship between digital rural governance and farmers' income growth from two theoretical perspectives: the endogenous development theory and the transaction cost theory, and on this basis, puts forward the research hypothesis of this paper.

3.1 Endogenous Development Theory

The endogenous development theory holds that the sustainable development of rural areas cannot rely on the simple input of external resources, but should take local resource endowments, cultural traditions

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and residents' subjective initiative as the core, and realize the sustainable development of rural economy by cultivating and strengthening the internal development capacity of rural areas. Digital rural governance is an important means to activate the endogenous driving force of rural development. It does not simply introduce external digital resources, but uses digital tools and platforms to help rural main bodies effectively mobilize and integrate local characteristic resources, cultivate and develop new business forms such as "Internet Plus characteristic agriculture" and digital rural tourism, and form a virtuous circle of innovation-driven development in rural areas. This development model based on local endogenous momentum can optimize the industrial structure of rural areas and expand the income channels of farmers, thus providing a stable structural support for the sustained growth of farmers' income.

3.2 Transaction Cost Theory

The transaction cost theory proposed by Coase holds that information asymmetry and coordination cost are the key factors affecting the efficiency of market transactions. In the traditional rural market operation system, the problems of information blockage, imperfect logistics system and non-standard transaction rules lead to high search cost, negotiation cost and supervision cost in the process of agricultural product transactions. Digital rural governance can effectively solve the above problems by building an open and shared rural information network and a standardized e-commerce transaction platform. On the one hand, it can reduce the information search cost and credit investigation cost of farmers in the process of participating in market transactions; on the other hand, it can standardize the transaction process of agricultural products and reduce the contract execution cost in the transaction process. This not only enables farmers to directly participate in the market transaction of agricultural products, reduces their dependence on intermediate links, but also increases the proportion of farmers in the value distribution of agricultural product industrial chains, thus effectively improving the income level of farmers.

3.3 Research Hypothesis

Based on the above analysis of the endogenous development theory and the transaction cost theory, digital rural governance can optimize the allocation of rural production factors, reduce market transaction costs, cultivate new rural business forms and expand farmers' employment channels through multiple paths, thus effectively promoting the growth of farmers' income at the county level. Therefore, this paper puts forward the following research hypothesis:

The improvement of the level of digital rural governance has a significant positive effect on the increase of rural residents' income at the county level.

4. Research Design

4.1 Model Specification

In order to empirically test the impact of digital rural governance on farmers' income at the county level, this paper constructs the following baseline regression model based on the two-way fixed effects model, so as to control the individual fixed effects of counties and the time fixed effects of different years and avoid the estimation bias caused by unobservable factors.

$$RI_{it} = \alpha_0 + \alpha_1 DIG_{it} + \alpha_n X_{it} + \delta_i + \varphi_t + \varepsilon_{it}$$

where RI_{it} represents per capita farmer income in county i in year t, α_0 is the constant term, α_1 and α_n denote the regression coefficients of the relevant variables, DIG_{it} measures the level of digital rural governance in county i in year t, X_{it} represents a set of control variables for county i in year t, δ_i denotes individual fixed effects, φ_t denotes time fixed effects, and ε_{it} is the random error term. The subscripts i and t refer to county and year, respectively. The coefficient α_1 is the focus of this study, representing the net effect of digital rural construction on rural residents' income. If α_1 is positive and statistically significant, the research hypothesis is supported.

4.2 Variable Selection and Data Sources

4.2.1 Data Sources

The data are drawn from three sources. The digital rural index, which captures the level of digital rural development, is taken from the *County Digital Rural Index* reports for 2018, 2019, and 2020, jointly released by Peking University's Institute of New Rural Development and the Ali Research Institute. This index uses a range of Alibaba Group internet data to build an indicator system covering eight dimensions: digital production, digital supply chain, digital marketing, digital finance, digital governance tools, digital consumption, digital culture, education and health, and digital life. It serves as a comprehensive measure of digital rural development across Chinese counties. Second, county-level indicators—such as per capita farmers' income, secondary industry output value, year-end financial institution loans, year-end urban and rural savings deposits, and local fiscal expenditure—are obtained from the *China County Statistical Yearbook* (2018–2020) and local statistical publications. Third, the CSMAR database provides data on the consumer price index and regional per capita GDP.

4.2.2 Explained Variable

Per capita income of rural residents (RI): Referring to the research method of Han Xudong and other scholars (2021), this paper selects the per capita disposable income of rural residents at the county level as the explained variable, which can directly and accurately reflect the economic welfare level of rural residents and the actual effect of digital governance policies on farmers' income growth. This indicator is regularly released by national and local statistical departments, with strong statistical accuracy and quantitative characteristics, and is a commonly used indicator in empirical research on farmers' income issues. In order to reduce the influence of data heteroscedasticity, this paper takes the logarithmic processing of this indicator in the empirical regression.

4.2.3 Core Explanatory Variable

Digital rural development index (DIG): Drawing on the research of Qiu Zeqi and his research team (2020), this paper selects the digital rural index from the "County Digital Rural Index Database" as the core explanatory variable to measure the level of digital rural governance at the county level. This index is jointly developed by well-known academic research institutions and enterprise research institutions in

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China, and adopts a multi-dimensional and multi-index measurement framework, which can effectively avoid the estimation bias caused by a single indicator and ensure the systematicness and rigor of the evaluation of digital rural development level. Similarly, this paper takes the logarithmic processing of this index to reduce the volatility of the data and minimize the estimation error of the model.

4.2.4 Control Variables

In order to exclude the interference of other factors on the research conclusion and accurately estimate the net effect of digital rural governance on farmers' income growth, this paper selects the following four control variables based on the existing research results and the actual situation of county economic development:

(1) Industrial Structure (is)

Measured by the proportion of the added value of the secondary industry in the GDP of each county. The optimization and upgrading of industrial structure is an important factor affecting the income level of rural residents. The higher the proportion of the secondary and tertiary industries, the higher the labor productivity and value-added capacity of the regional economy, which will further drive the growth of farmers' income. Controlling this variable can effectively avoid the omitted variable bias caused by the overlap between digital rural development and industrial structure upgrading.

(2) Government Support (gov)

Expressed by the ratio of local fiscal expenditure to regional GDP. The fiscal support of local governments is an important external driving force for digital rural construction and rural economic development. Controlling this variable can separate the market-driven effect and policy-driven effect of digital rural governance on farmers' income growth, so as to more accurately identify the actual effect of digital rural governance itself.

(3) Financial Development Level (fdl)

Calculated by the ratio of the year-end loan balance of financial institutions in each county to the regional consumer price index (CPI). The development level of rural finance is closely related to the income growth of farmers. Digital rural development and rural financial reform interact with each other. Controlling this variable can effectively isolate the joint effect of digital finance and traditional financial services on farmers' income growth.

(4) Residents' Savings Level (rsl)

Measured by the ratio of the year-end balance of urban and rural savings deposits in each county to the regional consumer price index (CPI). The savings level of residents reflects the capital accumulation capacity of regional residents, and capital accumulation is an important factor promoting income growth. Controlling this variable can prevent the income growth caused by capital accumulation from being incorrectly attributed to the effect of digital rural construction.

Descriptive statistics of the variables are presented in Table 1.

Table 1. Descriptive Statistics of Variables

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
RI	825	16391.83	6720.163	7966	42296
dig	825	59.41485	13.2576	32.54359	122.0829
Is	825	0.355782	.1282402	.0787468	.6927098
gov	825	0.2803364	.1847231	.0218097	1.135853
fdl	825	2.334866	2.842022	.1269344	25.04088
rsl	825	1.824044	1.965423	.2186092	16.37902

5. Regression Results

5.1 Baseline Model Regression

Table 2 reports the baseline regression results including OLS, individual fixed effects, time fixed effects and two-way fixed effects models. The regression coefficient of the digital rural development index (dig) is significantly positive at the 1% or 5% level in all four models, verifying the research hypothesis that digital rural governance significantly promotes farmers' income growth. In the two-way fixed effects model with the strongest explanatory power, the coefficient is 0.001 (significant at the 5% level), meaning that for every 1% increase in the digital rural development index, farmers' per capita income increases by 0.001% after controlling for other factors.

Digital rural governance promotes income growth through three core mechanisms: e-commerce empowerment (direct farmer-consumer transactions reduce intermediate links and increase actual income), employment expansion (digital new business forms create a large number of off-farm jobs and increase wage income), and efficiency improvement (digital technologies optimize agricultural production decisions, reduce costs and improve operating income).

The regression results of control variables also have economic implications: the significantly negative coefficient of industrial structure (is) may be due to the insufficient driving effect of secondary industry development on rural employment; the negative coefficient of government support (gov) may be related to unreasonable fiscal expenditure structure; financial development level (ln_fdl) and residents' savings level (ln_rsl) show significantly positive effects on farmers' income growth.

Table 2. Baseline Regression Results

	OLS	Individual FE	Time FE	Two-way FE
dig	0.013***	0.001**	0.001**	0.001**
	(0.001)	(0.000)	(0.000)	(0.000)
is	0.330***	-0.326***	-0.326***	-0.326***
	(0.069)	(0.036)	(0.036)	(0.036)

gov	-0.264***	-0.138***	-0.138***	-0.138***
	(0.052)	(0.040)	(0.040)	(0.040)
ln_fdl	-0.041**	0.266***	0.266***	0.266***
	(0.020)	(0.023)	(0.023)	(0.023)
ln_rsl	0.171***	0.200***	0.200***	0.200***
	(0.020)	(0.027)	(0.027)	(0.027)
2018.year				0.001**
				(.)
2019.year				0.097***
				(0.001)
2020.year				0.173***
				(0.002)
_cons	8.816***	9.602***	9.602***	9.568***
	(0.052)	(0.027)	(0.027)	(0.006)
N	825	825	825	825

Note. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; robust standard errors are shown in parentheses.

5.2 Robustness Test

This paper replaces the explained variable (farmers' per capita income) with county per capita GDP for robustness testing, and the results are shown in Table 3. The regression coefficient of the digital rural development index (DIG) is still significantly positive at the 1% or 5% level in all models, indicating that digital rural governance significantly promotes regional economic development, and further confirms the stable and reliable income-increasing effect of digital rural governance. The robustness test results are consistent with the baseline regression, proving that the research conclusion is not affected by the selection of explained variables.

Table 3. Robustness Test Results

	(1)	**(2)**	**(3)**
	OLS_GDP	**FE_GDP**	**TwoWay_GDP**
DIG	0.004***	0.0106***	0.001**
	(0.001)	(0.001)	(0.001)
IS	1.197***	0.763***	0.954***
	(0.082)	(0.080)	(0.084)
GOV	-1.222***	-1.128***	-1.069***
	(0.062)	(0.090)	(0.088)
ln_fdl	0.276***	0.372***	0.260***
	(0.024)	(0.051)	(0.055)
ln_rsl	0.458***	0.031	-0.092
	(0.024)	(0.061)	(0.063)
year=2018			0.000
			(.)
year=2019			0.063***
			(0.010)
year=2020			0.088***
			(0.017)
Constant	14.287***	14.248***	14.210***
	(0.062)	(0.061)	(0.060)
Observations	825	825	825

Note. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively; robust standard errors are shown in parentheses.

6. Conclusions and Recommendations

6.1 Research Conclusions

Based on the panel data of 275 counties from 2018 to 2020 and the two-way fixed effects model, this paper draws the following conclusions:

1.   Digital rural governance has a significant positive effect on county-level farmers' income growth, and this conclusion is stable and reliable after robustness testing.

2.   The income-increasing effect is realized through three mechanisms: e-commerce empowerment, employment expansion and efficiency improvement, realizing multi-channel income growth for farmers.

3.   County-level industrial structure, government support, financial development and residents' savings all affect farmers' income growth, and their coordinated development with digital rural governance is a prerequisite for giving full play to the income-increasing effect.

6.2 Policy Recommendations

Based on the research conclusions, the following policy suggestions are put forward to advance high-quality digital rural governance and boost farmers' income:

1.   Implement phased digital rural construction policies: Adopt the "pilot exploration - summary review - scaled promotion" path, select counties with solid foundations for pilot projects, and promote successful experiences step by step to avoid blind and rapid promotion.

2.   Improve the supporting guarantee system: Establish special digital rural development funds, carry out targeted digital skill training for rural residents, and strengthen the construction and operation maintenance of rural digital infrastructure.

3.   Promote the deep integration of digital technology and rural industries: Vigorously develop digital agriculture, support rural digital new business forms such as live-streaming e-commerce, guide financial institutions to develop targeted digital financial products, and build a "government-market-society" collaborative development mechanism.

4.   Construct a scientific evaluation system: Establish a multi-dimensional evaluation index system covering economic, social and ecological benefits, extend the evaluation cycle to 5-8 years, and formulate differentiated evaluation criteria according to local conditions.

5.   Enhance rural digital inclusion: Develop simple and easy-to-use digital tools for rural vulnerable groups such as the elderly and small-scale farmers, retain traditional service channels while promoting digital transformation, and ensure all rural residents share the dividends of the digital economy.

Funding

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